Fish Distribution in Submerged Shallow Water Habitats Using Underwater Videography in Puget Sound

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Extended Abstract

Introduction

Fish distribution data were collected from submerged shallow water habitats between Shilshole Bay Marina and Picnic Point (Figure 1) in support of a King County Wastewater Treatment Division's Habitat Conservation Plan (HCP) and Marine Outfall Siting Study (MOSS). During this study, approximately 22 km of nearshore habitat were mapped between depths of +1 m and –30 m (mean lower low water) using side-scan sonar to delineate and map eelgrass and substrate types on georeferenced images. Underwater video footage was collected to ground-truth the sonar imagery and map the presence and location of fish, kelp beds, and benthic macro invertebrates. The study generated approximately 144 km of georeferenced underwater video. The underwater videography data was then integrated with side scan sonar data to produce GIS maps for the analysis of fish species and habitat distribution.

Figure 1. Location of study area

Methods

Video Collection

Underwater videography surveys were conducted between October 6, 1999 and November 14, 1999. Battelle conducted the majority of the underwater videography (tracklines parallel to shore) using a Sony CCD-V101 low light, high-resolution analog camera with a 2.3mm F1.4 wide-angle lens (Photos 1) using a PNNL custom built aluminum tow sled with a vertical stabilizer and bottom skids to protect the camera system. MRC collected the perpendicular videography surveys (tracklines perpendicular to shore) using a SeaCam 2000 from DeepSea Power and Light, and a Hitachi VK-C150 CCD camera, with 4.8 mm Cosmicar auto-iris lens (Photo 2).

Video Post Processing

Fish were identified to the nearest genus or closest possible scientific classification. In such cases where it was positively identified as a fish, but no further distinguishing characteristics could be determined it was recorded as "unidentified." Fish observations were recorded; species identified; categorized as individual or schooling; given a density estimate followed by the number of individuals if it was classified as an individual. Video observations of fish were mapped in GIS software and analyzed in spatial relation to substrate and habitat type.

Photo 1. Example of parallel video: Pile perch and eelgrass

Photo 2. Example of perpendicular video: Starry flounder on sand

Preliminary Results

915 video observations of fish were recorded: 402 schooling fish, and 513 individual fish. The video observations resulted in 775 individual fish, and an estimated 15,400 to 26,700 (+) schooling fish.

The schooling species occurring most frequently were shiner surfperch (*Cymatogaster aggregata*, 154 observations) followed by tubesnouts (*Aulorhynchus flavidus*, 104 observations). Flatfish (Bothidae or Pleuronectidae, 295 observations) were the most observed species of non-schooling fish followed by ratfish (*Hydrolagus collie*, 174 observations). The ranking of major habitat/substrate utilization for *schooling fish*, based on numbers of observations are: (1) sand, (2) eelgrass, (3) mixed course, and (4) boulder (Table 1). The ranking of major habitat/substrate utilization for *non-schooling fish*, based on numbers are: (1) sand,

(2) equal ranking for eelgrass and mixed course, (3) gravel, and (4) equal rankings for eelgrass, gravel, and boulder (Table 2).

Table 1. Schooling fish rankings based on number of observations of fish type in major habitat and substrate classifications. *

Code	**Common Name**	**Eelgrass**	**Sand**	**Gravel**	**Mixed Coarse**	**Cobble**	**Boulder**
uid	Unidentified	3	1	4	2		
emb	Unidentified surfperch	2	1		3		4
pil	Pile surfperch	3	1		2		
str	Striped surfperch		3				
shi	Shiner surfperch	2	1	4	3		5
uip	Unidentified surfperch (Striped or Pile)	1	2		3		4
tub	Tubesnout	1	2	4	3		
uib	Unidentified baitfish (Herring or Sand lance)	2	1	1			

* Rank of 1 equals greatest number of observations. Repetitive numbers equal the same number of observations.

Table 2. Non-Schooling fish rankings based on number of observations of fish type in major habitat and substrate classifications. *

Code	**Common Name**	**Eelgrass**	**Sand**	**Gravel**	**Mixed Coarse**	**Cobble**	**Boulder**
uif	Unidentified flatfish	3	1	4	2		
cit	Sanddab		1	2			
ple	Unidentified right-eyed flatfish		3				
sta	Starry flounder	2	1				
cot	Unidentified sculpin		1		2		
uis	Unidentified sculpin either Buffalo or Great		1				
gre	Greenling		2		1		
cab	Cabezon	2	1	3			
lin	Lingcod	2			1		

loc	Lingcod or Cabezon	2	1		2		
seb	Unidentified rockfish		1				
qui	Quillback rockfish		1				1
rtf	Rat fish	4	1	3	2		4
raj	Skate		1				

* Rank of 1 equals greatest number of observations. Repetitive numbers equal the same number of observations.

Conclusions

The large-scale use of videography and GIS allows a greater understanding of habitat utilization by fish and provides a useful tool to managers and scientists alike. This method of observation offers two distinct advantages: (1) It is non-invasive and non-destructive to the habitat, and (2) It provides a synoptic view of fish location in relation to habitat

This data has a great deal of potential for further analysis that will aid in understanding linkages between fishes and habitat/substrate relationships. However, we realize the inherent disadvantages of such a large scale study, which include the difficulty in observing all species and numbers in areas with extensive cover (eelgrass, kelp, and macroalgae), limitations to identification of species, and observing species spending a majority of time in the mid- to upper- water column.

It is evident that sand and eelgrass play an important ecological role of habitat utilization based on the frequency of fish observations. However, for further analysis it would be important to weight the sample effort and number of observations to habitat size and function.

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